

Notice of Allowability**Application No.**

10/809,115

Applicant(s)

POUCHAK ET AL.

Examiner

Patrick F. O'Reilly III

Art Unit

3749

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to the Amendment dated July 15, 2009.
2. ☒ The allowed claim(s) is/are 1-13 and 15-27.
3. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some* c) ☐ None of the:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
5. ☒ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
(a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
(b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date 4/15/2010.
- Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☒ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO/SB/08),
Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application
6. ☒ Interview Summary (PTO-413),
Paper No./Mail Date 4/14/2010.
7. ☒ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

/Patrick F. O'Reilly III/
Examiner, Art Unit 3749

Drawings

1. New corrected drawings in compliance with 37 CFR 1.121(d) are required in this application because, in Figure 13, it appears that block “328” should be corrected to read: “Fill in Empty Stages”. Applicant is advised to employ the services of a competent patent draftsman outside the Office, as the U.S. Patent and Trademark Office no longer prepares new drawings. The corrected drawings are required in reply to the Office action to avoid abandonment of the application. The requirement for corrected drawings will not be held in abeyance.

EXAMINER’S AMENDMENT

2. An examiner’s amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner’s amendment was given in a telephone interview with Brian N. Tufte, Attorney for Applicants, on April 14, 2010 and April 15, 2010.

3. The claims have been amended as follows:

Replace **claim 1** in its entirety with the following:

--1. A computer implemented method of operating a boiler system having a plurality of boiler stages which may be active or inactive at a given time, the boiler stages having outputs, the method comprising:

performing a boiler staging sequence, at a first timed interval, to determine how many of the plurality of boiler stages should be active or inactive, the boiler staging sequence including:

implementing a boiler addition control loop to make a first number of the plurality of boiler stages active based at least partially on a calculated error rate, and

implementing a boiler removal control loop to make a second number of the plurality of boiler stages inactive based at least partially on the calculated error rate; and

performing a boiler modulation sequence, at a second timed interval shorter than the first timed interval, the boiler modulation sequence including:

using the determinations made during the boiler staging sequence as to how many of the plurality of boiler stages should be active and inactive;

modulating a first boiler stage to operate at less than 100% of its output, and

modulating a second boiler stage to operate at less than 100% of its output;

wherein the first and second boiler stages are modulated while both boiler stages are active.-- ;

In **claim 2**, line 2, the word --boiler-- has been inserted between the word “of” and the word “stages”;

In **claim 2**, line 3, the word --boiler-- has been inserted between the word “a” and the word “staging”;

In **claim 3**, line 2, the word --boiler-- has been inserted between the word “the” and the word “stages”;

In **claim 5**, line 2, the word --boiler-- has been inserted between the word “the” and the word “stages”;

In **claim 6**, bridging lines 1 and 2, the phrase “configured to perform” has been deleted and the word --performing-- has been added in its place;

In **claim 7**, bridging lines 1 and 2, the phrase “configured to perform” has been deleted and the word --performing-- has been added in its place;

Replace **claim 8** in its entirety with the following:

--8. A computer implemented method of providing heat capacity in response to a heat load using a boiler system having a plurality of boiler stages that may be active or inactive at a given time, the method comprising:

performing a boiler staging sequence, at a first timed interval, to determine which of the plurality of boiler stages should be active or inactive, the boiler staging sequence including:

implementing a boiler addition control loop to make a first number of the plurality of boiler stages active based at least partially on a calculated error rate,

implementing a boiler removal control loop to make a second number of the plurality of boiler stages inactive based at least partially on the calculated error rate, and

activating the determined active boiler stages, if any; and

performing a boiler modulation sequence, at a second timed interval shorter than the first timed interval, the boiler modulation sequence including:

using the determinations made during the boiler staging sequence as to how many of the plurality of boiler stages should be active and inactive;

and when the determined active boiler stages includes two or more of the plurality of boiler stages, modulating the active boiler stages, while they are active.-- ;

In **claim 9**, line 2, the word --boiler-- has been inserted between the word “active” and the word “stages”;

In **claim 9**, line 2, the word --boiler-- has been inserted between the word “active” and the word “stage”;

In **claim 10**, line 2, the word --boiler-- has been inserted between the word “active” and the word “stages”;

In **claim 10**, line 3, the word --boiler-- has been inserted between the word “active” and the word “stages”;

In **claim 11**, bridging lines 1 and 2, the phrase “configured to perform” has been deleted and the word --performing-- has been added in its place;

Replace **claim 12** in its entirety with the following:

--12. A computer implemented method of operating a boiler system having a plurality of boiler stages which may be active or inactive at a given time, the method comprising the steps of:

performing, at a first timed interval, a boiler staging sequence to determine how many of the boiler stages should be active or inactive, the boiler staging sequence including:

implementing a boiler addition control loop to make a first number of the plurality of boiler stages active based at least partially on a calculated error rate, and

implementing a boiler removal control loop to make a second number of the plurality of boiler stages inactive based at least partially on the calculated error rate; and

performing, at a second timed interval shorter than the first timed interval, a modulating boiler sequence to modulate the active boiler stages, the modulating boiler sequence including:

setting values for use in the modulating boiler sequence, which includes the setting of the total heat command to the amount of heat demanded at that particular time, and

using the determinations made during the boiler staging sequence as to how many of the plurality of boiler stages should be active and inactive.-- ;

In **claim 13**, line 2, the word --boiler-- has been inserted between the word “the” and the word “staging”;

In **claim 13**, line 2, the word --boiler-- has been inserted between the word “inactive” and the word “stage”;

In **claim 13**, line 3, the word --boiler-- has been inserted between the word “active” and the word “stage”;

In **claim 13**, line 4, the word --boiler-- has been inserted between the word “inactive” and the word “stage”;

In **claim 13**, line 5, the word --boiler-- has been inserted between the word “inactive” and the word “stage”;

In **claim 13**, line 6, the word --boiler-- has been inserted between the word “active” and the word “stage”;

In **claim 13**, line 7, the word --boiler-- has been inserted between the word “active” and the word “stage”;

Claim 14 has been cancelled.

In **claim 15**, bridging lines 2 and 3, the word --boiler-- has been inserted between the word “a” and the word “stage”;

In **claim 16**, bridging lines 1 and 2, the phrase “configured to perform” has been deleted and the word --performing-- has been added in its place;

Replace **claim 17** in its entirety with the following:

--17. A computer implemented method of controlling a multi-stage boiler system having a number of boiler stages that can be either active or inactive, the method comprising the steps of:

calculating an error based upon a difference between a boiler system fluid return temperature and a setpoint;

determining whether to make an inactive boiler stage active based at least partially on the calculated error; and

determining whether to make an active boiler stage inactive based at least partially on the calculated error; wherein:

a first time delay is provided after making an inactive boiler stage active and before a determination is made whether or not to activate any additional boiler stages,

a second time delay is provided after making an active boiler stage inactive and before a determination is made whether or not to deactivate any additional boiler stages;

wherein the first time delay is longer than the second time delay; and

wherein the first and second time delays are used to preserve stability in the multi-stage boiler system by limiting over-cycling due to excessively quick staging.-- ;

Replace **claim 18** in its entirety with the following:

--18. A computer implemented method of staging and modulating a boiler system in response to a load comprising the steps of:

staging and modulating the boiler system using a first control method that is adapted for achieving increased efficiency under a first set of boiler system conditions, which first set of conditions include a calculated system error being less than a predetermined quantity; and

staging and modulating the boiler system using a second control method that is adapted to allow cycling of boiler stages under a second set of boiler system conditions, which second set of conditions include a boiler being taken offline for maintenance;

wherein at least one of the first control method and the second control method includes:

performing, at a first timed interval, a boiler staging sequence to determine how many of the boiler stages should be active; and

performing, at a second timed interval shorter than the first timed interval, a modulating boiler sequence to modulate the active boiler stages.-- ;

In **claim 20**, line 2, the word --boiler-- has been inserted between the word “the” and the word “system”;

In **claim 22**, line 2, the phrase “at least one” has been deleted and the word --both-- has been added in its place;

In **claim 22**, line 3, the word --timed-- has been inserted between the word “first” and the word “interval”;

In **claim 22**, line 3, the word --boiler-- has been inserted between the word “a” and the word “staging”;

In **claim 22**, line 3, the word --boiler-- has been inserted between the word “the” and the word “stages”;

In **claim 22**, line 5, the word --timed-- has been inserted between the word “second” and the word “interval”;

In **claim 22**, line 5, the word --timed-- has been inserted between the word “first” and the word “interval”;

In **claim 22**, line 5, the word --boiler-- has been inserted between the word “modulating” and the word “sequence”;

In **claim 22**, line 6, the word --boiler-- has been inserted between the word “active” and the word “stages”;

In **claim 23**, line 3, the word --boiler-- has been inserted between the word “active” and the word “stage”;

In **claim 23**, line 3, the word --boiler-- has been inserted between the word “inactive” and the word “stage”;

In **claim 23**, line 5, the word --boiler-- has been inserted between the word “inactive” and the word “stage”;

In **claim 23**, line 6, the word --boiler-- has been inserted between the word “inactive” and the word “stage”;

In **claim 23**, line 7, the word --boiler-- has been inserted between the word “active” and the word “stage”;

In **claim 23**, line 8, the word --boiler-- has been inserted between the word “active” and the word “stage”;

Replace **claim 25** in its entirety with the following:

--25. A computer implemented method of performing a staging sequence for a multi-stage boiler system in which at least one boiler stage can be either active or inactive, the method comprising the steps of:

calculating an error based upon a difference between a boiler system fluid return temperature and a setpoint;

determining a rate of change of the error, the rate of change of the error being determined based upon a computed difference between a current measured value and an old measured value of the boiler system fluid return temperature;

and mathematically combining the error and the rate of change of the error to determine whether:

an inactive boiler stage should become active;

an active boiler stage should become inactive;

or, if it is determined that neither an inactive boiler stage should become active nor an active boiler stage should become inactive, determining that no change in the number of active stages is necessary.-- ;

In **claim 26**, bridging lines 1 and 2, the phrase “configured to perform” has been deleted and the word --performing-- has been added in its place;

In **claim 27**, line 2, the word --boiler-- has been inserted between the word “first” and the word “stage”;

In **claim 27**, line 3, the word --boiler-- has been inserted between the word “second” and the word “stage”;

In **claim 27**, line 4, the word --boiler-- has been inserted between the word “second” and the word “stages”.

4. The specification has been amended as follows:

On page 2 of the original specification, in line 12, the word “observes” has been deleted;

On page 6 of the original specification, in line 10, the word “boilers” has been deleted and the word --boiler-- has been added in its place;

On page 6 of the original specification, in line 15, the word --at-- has been inserted between the word “operating” and the word “a”;

On page 7 of the original specification, in line 7, the word “controls” has been deleted and the word --control-- has been added in its place;

On page 7 of the original specification, in line 23, the blank space, which immediately follows the word “number”, has been deleted and application number --10/809,116-- has been added in its place;

On pages 7-8 of the original specification, bridging line 23 of page 7 and line 1 of page 8, the title “COLD WATER BYPASS AND FIRING RATE CONTROL,” has been deleted and the following title and associated patent number has been added in its place: --FORWARD CALCULATION ENERGY AUGMENTATION METHOD, now U.S. Patent No. 6,904,874-- ;

On page 9 of the original specification, in line 13, the blank space, which immediately follows the word “Number”, has been deleted and application number --10/809,116-- has been added in its place;

On page 11 of the original specification, in line 16, the phrase “regardless how may of the stages” has been deleted and the phrase --regardless of how many of the stages-- has been added in its place;

On page 12 of the original specification, in line 14, the word “note” has been deleted and the word --node-- has been added in its place;

On page 12 of the original specification, in line 17, the phrase --mode controller 214-- has been inserted between the comma and the word “and”;

On page 13 of the original specification, in line 6, the word --to-- has been inserted between the word “passed” and the word “the”;

On page 14 of the original specification, in line 8, the word “Echelong” has been deleted and the word --Echelon-- has been added in its place;

On page 15 of the original specification, in line 14, the figure designation “Figure 4” has been deleted and the figure designation --Figure 7-- has been added in its place;

On page 27 of the original specification, in line 7, the phrase --in step 328-- has been inserted between the word “set” and the period;

On page 28 of the original specification, in line 7, the phrase --in step 332-- has been inserted between the word “iteration” and the comma;

On page 28 of the original specification, in line 10, the word --using-- has been inserted between the word “met” and the word “certain”;

On page 29 of the original specification, in line 15, the word “delay” has been deleted;

On page 31 of the original specification, in line 22, the phrase --in block 370-- has been inserted between the word “step” and the period;

On page 33 of the original specification, in line 6, the phrase --in block 382-- has been inserted between the word “checked” and the semi-colon;

On page 33 of the original specification, in line 23, the figure designation “Figure 17A” has been deleted and the figure designation --Figure 18A-- has been added in its place;

On page 35 of the original specification, bridging lines 9 and 10, the word --an-- has been inserted between the word “for” and the word “additional”;

5. The abstract has been amended as follows:

In line 7 of the original abstract, the word “observes” has been deleted.

REASONS FOR ALLOWANCE

6. The following is an examiner’s statement of reasons for allowance:

The prior art references, neither alone nor in combination, disclose, teach or suggest computer implemented methods of operating/controlling a boiler system having the combination of elements recited in independent claims 1, 8, 12, 17, 18, and 25 (as amended above).

Specifically, with respect to independent claims 1, 8, 12, and 18, the closest prior art is considered to be that of the Lochinvar Publication, “Sequencing Options Mean New Levels of Building Efficiency” (hereinafter “Lochinvar”) and Shprecher et al. (US 5,042,431). While the combined teachings of Lochinvar and Shprecher et al. may disclose some of the claimed limitations, claims 1, 8, and 12 are clearly patentable over these references, whether considered individually or in combination, because these references fail to disclose, teach, or suggest at least the following claimed elements: (a) “performing a boiler staging sequence, *at a first timed interval*, to determine how many of the plurality of boiler stages should be active or inactive, the boiler staging sequence including: (i) implementing a *boiler addition control loop* to make a first number of the plurality of boiler stages active based at least partially on a calculated error rate, and (ii) implementing a *boiler removal control loop* to make a second number of the plurality of boiler stages inactive based at least partially on the calculated error rate; and (b) performing a boiler modulation sequence, *at a second timed interval shorter than the first timed interval* (emphasis added)”. Similarly, claim 18 is also clearly patentable over these references, whether considered individually or in combination, because these references fail to disclose, teach, or suggest at least the following claimed elements: “wherein at least one of the first control method

and the second control method includes: (i) performing, *at a first timed interval*, a boiler staging sequence to determine how many of the boiler stages should be active; and (ii) performing, *at a second timed interval shorter than the first timed interval*, a modulating boiler sequence to modulate the active boiler stages (emphasis added)”.

Moreover, one of ordinary skill in the art would have no reasonable motivation for modifying the Lochinvar base reference so as to overcome the deficiencies recited above. For example, one of ordinary skill in the art would have no motivation at all to perform a boiler staging sequence at a first timed interval, and a boiler modulation sequence at a second timed interval, wherein the second timed interval is shorter than a first timed interval. If one of ordinary skill in the art were to follow the teachings of the Shprecher et al. secondary reference, he or she would merely provide a boiler controller with an adjustable short-cycling delay for a boiler that is operating in a “standby” mode. Refer to Shprecher et al., Figures 1-2, column 3, lines 57-60; column 4, lines 53-68; and column 5, lines 1-2. Shprecher et al. makes no mention of utilizing time delays of two different time durations in the context of a boiler staging sequence and a boiler modulation sequence. Thus, Shprecher et al. would only lead one of ordinary skill in the art away from the claimed invention, and would do nothing to help remedy the deficiencies of Lochinvar. Therefore, because the closest prior art fails to disclose, teach, or suggest numerous limitations set forth in claims 1, 8, 12, and 18, and there is no reasonable motivation for one of ordinary skill in the art to modify the closest prior art references (Lochinvar and Shprecher et al.) in such a way so as to cure these deficiencies, independent claims 1, 8, 12, and 18 of this application are clearly patentable over the prior art.

In addition, with respect to independent claim 17, the closest prior art is also considered to be that of Lochinvar and Shprecher et al. While the combined teachings of Lochinvar and Shprecher et al. may disclose some of the claimed limitations, claim 17 is clearly patentable over these references, whether considered individually or in combination, because these references fail to disclose, teach, or suggest at least the following claimed elements: (a) “a *first time delay* [being] provided after making an inactive boiler stage active and before a determination is made whether or not to activate any additional boiler stages; (b) a *second time delay* [being] provided after making an active boiler stage inactive and before a determination is made whether or not to deactivate any additional boiler stages; (c) wherein *the first time delay is longer than the second time delay*; and (d) wherein the first and second time delays are used to preserve stability in the multi-stage boiler system by limiting over-cycling due to excessively quick staging (emphasis added)”.

Moreover, one of ordinary skill in the art would have no reasonable motivation for modifying the Lochinvar base reference so as to overcome the deficiencies recited above. For example, one of ordinary skill in the art would have no motivation at all to provide a first time delay after making an inactive boiler active and a second time delay after making an active boiler stage inactive, wherein the first time delay is longer than the second time delay. If one of ordinary skill in the art were to follow the teachings of the Shprecher et al. secondary reference, he or she would merely provide a boiler controller with an adjustable short-cycling delay for a boiler that is operating in a “standby” mode. Refer to Shprecher et al., Figures 1-2, column 3, lines 57-60; column 4, lines 53-68; and column 5, lines 1-2. Shprecher et al. makes no mention of utilizing time delays of two different time durations when making an inactive boiler active,

and when making an active boiler stage inactive. Thus, Shprecher et al. would only lead one of ordinary skill in the art away from the claimed invention, and would do nothing to help remedy the deficiencies of Lochinvar. Therefore, because the closest prior art fails to disclose, teach, or suggest numerous limitations set forth in claim 17, and there is no reasonable motivation for one of ordinary skill in the art to modify the closest prior art references (Lochinvar and Shprecher et al.) in such a way so as to cure these deficiencies, independent claim 17 of this application is clearly patentable over the prior art.

Furthermore, with respect to independent claim 25, the closest prior art is considered to be that of Hull et al. (US 2004/0256473 A1). While Hull et al. may disclose some of the claimed limitations, claim 25 is clearly patentable over the Hull et al. reference because this reference fails to disclose, teach, or suggest at least the following claimed elements: (a) determining a *rate of change of the error*, the rate of change of the error being determined based upon a computed difference between a current measured value and an old measured value of the boiler system fluid return temperature; and (b) mathematically combining the error and the rate of change of error to determine whether (i) an *inactive boiler stage* should become *active*; and (ii) an *active boiler stage* should become *inactive*; (ii) or, if it is determined that neither an inactive boiler stage should become active nor an active boiler stage should become inactive, determining that no change in the number of active stages is necessary (emphasis added)".

Also, one of ordinary skill in the art would have no reasonable motivation for modifying the Hull et al. reference so as to overcome the deficiencies recited above. First, Hull et al. relates to the control of damper position (see e.g., Fig. 1) and the control of a flow regulation device (404 – see e.g., Fig. 4) serving a heat exchange coil (410), and not, the control of boiler stages in

a multi-stage boiler system. Secondly, while Hull et al. may disclose observing the manner in which error is changing in the context of a damper positioning system (see e.g., pg. 4, para. [0035]), Hull et al. clearly does not teach determining the rate of change of the error based upon a computed difference between a current measured value and an old measured value of a boiler system fluid return temperature. Moreover, one of ordinary skill in the art clearly would have no reasonable motivation at all to modify Hull et al. in such a manner so as to remedy these deficiencies because any such modifications would be so unrelated to the control systems disclosed in Hull et al. that no possible benefit could be derived from making the modifications. Consequently, it is abundantly clear that there is no possible way to arrive at the claimed invention of claim 25 unless one engages in impermissible hindsight reconstruction by improperly using the Applicant's disclosure as a roadmap. Therefore, because the closest prior art fails to disclose, teach, or suggest numerous limitations set forth in claim 25, and there is no reasonable motivation for one of ordinary skill in the art to modify the closest prior art reference (Hull et al.) in such a way so as to cure these deficiencies, independent claim 25 of this application is clearly patentable over the prior art.

In regard to dependent claims 2-7, 9-11, 13, 15-16, 19-24, and 26-27, these claims are allowable as being dependent, either directly or indirectly, upon allowable independent claims 1, 8, 12, 18, and 25.

7. Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Patrick F. O'Reilly III whose telephone number is (571) 272-3424. The examiner can normally be reached on Monday through Friday, 8:30 am to 5:30 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Steven B. McAllister can be reached on (571) 272-6785. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Patrick F. O'Reilly III/
Examiner, Art Unit 3749

/Steven B. McAllister/
Supervisory Patent Examiner, Art Unit 3749